Qualitative and quantitative analysis of palmar dermatoglyphics among smokeless tobacco users

Athreya Vijayaraghavan, Nalini Aswath

Department of Oral Medicine and Radiology, Sree Balaji Dental College and Hospital, Chennai, Tamil Nadu, India

ABSTRACT

Context: Palm prints formed once does not change throughout life and is not influenced by environment. Palmar Dermatoglyphics can indicate the development of potentially malignant and malignant lesions and help in identifying persons at high risk of developing Oral submucous fibrosis (OSMF) and Oral squamous cell carcinoma (OSSC).

Aim: To analyze the qualitative [finger ridge pattern and presence or absence of hypothenar pattern] and quantitative [mean ATD angle and total AB ridge count] variations in Palmar Dermatoglyphics in patients suffering from OSMF and OSCC.

Settings and Design: A prospective comparative study among 40 patients (Group I-10 samples of smokeless tobacco users with OSMF, Group II- 10 samples of smokeless tobacco users with OSCC, GroupIII- 10 samples of smokeless tobacco users without OSMF or OSCC and GroupIV- 10 samples without smokeless tobacco habit without OSMF and OSCC as controls) were selected.

Materials and Methods: The palm prints were recorded using an HP inkjet scanner. The patients were asked to place the palm gently on the scanner with the fingers wide apart from each other. The images of the palm prints were edited and qualitative and quantitative analysis were done.

Statistical Analysis Used: Statistical analysis such as Kruskal Wallis, Post Hoc and Analysis of Varience were done.

Results: A highly significant difference among the finger ridge, hypothenar pattern and mean ATD angle ($P<0.001$) and total AB ridge count ($P=0.005$) in OSMF and OSCC patients were obtained. There is predominance of arches and loops, presence of hypothenar pattern, decrease in mean ATD angle and total AB ridge count in OSMF and Oral Cancer patients.

Conclusion: Palmar Dermatoglyphics can predict the probable occurrence of OSMF and OSCC in smokeless tobacco users.

Key words: AB ridge count, ATD angle, finger ridge, hypothenar pattern, oral squamous cell carcinoma, oral-sub mucous fibrosis, palm prints

Dermatoglyphics relates to the surface characteristics of the skin with respect to its furrows, folds, wrinkles, and ridges or, in other words, its fine sculpturing. The science of dermatoglyphics involves the study of epidermal ridges present on the surface of palms, fingers, soles, and toes. The glyph is derived from a Greek verb meaning to carve. Over the past 150 years, dermatoglyphics has been a useful tool in understanding basic questions in biology, medicine, genetics, and evolution, in addition to being the best and most widely used method for personal identification. The development of dermatoglyphic patterns begins with the appearance of fetal pads in the 6th week of gestation and reaches maximum size between 12th and 13th weeks and ends with the appearance of finished patterns on the surface of the skin in the 24th week of gestation. From this stage onward, they are unaffected by the environment, and this explains their unique role, as an ideal marker for individual identification and the study of populations, as well as detection of defects due to intra-uterine irregularities in the early weeks of pregnancy. Dermatoglyphics are assumed to be genetically controlled, although the exact mechanism of inheritance is still unknown. Dermatoglyphics patterns were used previously in the study of chromosomal diseases, cardiac diseases, and leukemia. William Herschel (1858) was the first to experiment
with fingerprints in India. Now dermatoglyphics analytical method is utilized in quantitative and qualitative investigation of shapes and lines on the skin and is widely used in medicine, biology, and physical anthropology; and in recent years it is being used in dentistry.

The aim of the present study was to analyze the qualitative and quantitative variations in palmar dermatoglyphics among smokeless tobacco chewers without any lesion and with having oral sub mucous fibrosis, a precancerous condition and oral cancer with that of the normal patients without any habits.

MATERIALS AND METHODS

The patients enrolled in the study were clinically diagnosed as oral submucous fibrosis and oral cancer that is, oral squamous cell carcinoma (OSCC), and the palm prints were recorded after getting the informed consent. All cases of oral cancer were proven histopathologically. For the first time, the palm prints were recorded using a Hewlett-Packard inkjet scanner [Figure 1]. The patients were asked to place the palm gently on the scanner with the fingers wide apart from each other [Figure 1]. After the recording was done, the images of the palm prints were edited in the photoshop, and the following observations were made:

Triradius points formed by the convergence of three patterns of ridges [Figure 2].

Point A-triradii point present below the index finger [Figure 3].

Point B-TRIRADII point present below the middle finger [Figure 3].

Point D-triradii point present below the little finger [Figure 3].

Point T-triradii point present in the thenar area [Figure 3].

ATD angle is the angle that exists between the A, T, and D triradii on the palm. The angle is measured from the triangle formed by joining the points A, T, and D [Figure 4].

Finger ridge patterns are divided into three:

The arch has no triradius and is the simplest pattern [Figure 5].

The loop has one triradius and one core, and the ridges open away from the triradius toward the right or left [Figure 5].

The whorl has two or rarely three triradii [Figure 5]. The inside of the whorl is highly variable, there can be one or two cores, and the ridges can form concentric circles or have loop-like arrangements. The AB ridge count on one hand was measured by counting the number of ridges between point A and point B by drawing a line joining the triradii of point A to the triradii of point B formed by the convergence of three patterns of ridges. The pattern on the finger ridge was analyzed for the presence of any of the three finger patterns (whorls, arches, loops). The presence of pattern predominance in the hypothenar area was analyzed. It was repeated on the palm prints of the other hand. The
procedure was repeated on both control groups and cases. The qualitative analysis included the finger ridge pattern and the hypothenar patterns. The quantitative analysis included the AB ridge count and the ATD angle. After all the required analyses were done on the palm prints of both the hands the statistical analysis were done, and the results obtained were compared between the study groups and the control group.

SUBJECTS AND METHODS

A prospective comparative study was done, and a total of 40 patients were involved in the study. The study populations were divided into four groups. Group 1: Consists of 10 patients with smokeless tobacco chewing habit and diagnosed as having oral submucous fibrosis. Group 2: Consists of 10 patients with smokeless tobacco chewing habit and diagnosed as having oral cancer that is OSCC proven histopathologically. Group 3: Consists of 10 patients with smokeless tobacco chewing habit and diagnosed as not having oral submucous fibrosis and oral cancer. Group 4: Consists of 10 patients without smokeless tobacco chewing habit and diagnosed as not having oral submucous fibrosis and oral cancer (control group). The inclusion criteria included smokeless tobacco users, oral submucous fibrosis patients, and oral cancer patients. The exclusion criteria included patients having systemic diseases such as diabetes, hypertension, heart diseases, bronchial asthma, epilepsy, anemia, congenital diseases like congenital heart disease, patients having genetic disorders, and those having other malignant conditions. Patients not willing to participate in the study were excluded from the study. Statistical analysis such as Kruskal-Wallis, Post-hoc, and analysis of variance (ANOVA) were done.

RESULTS

Statistical analysis was done for both qualitative and quantitative analysis. Kruskal-Wallis test [Table 1] was done for analyzing the finger ridge pattern among the four study groups, and the result was found to be statistically significant for arches ($P = 0.003$), whorls ($P < 0.01$) and loops ($P < 0.01$). A Pearson Chi-square test [Table 2] was done for analyzing the hypothenar pattern, and the result was found to be statistically significant among all four study groups ($P < 0.01$). One way ANOVA test [Table 3] was done for ATD angle and AB ridge count among the four study groups and result was found to be statistically significant ($P < 0.01$). Further analysis was done by Post-hoc test [Table 4] for ATD angle and AB ridge count, and the results were statistically insignificant ($P = 0.005$).

DISCUSSION

The dermatoglyphic analysis is now beginning to prove itself as an extremely useful window for diagnosing conditions with a suspected genetic basis. Sir Francis Galton (1892) with his extensive research demonstrated the hereditary significance of fingerprints and biological variations of different racial groups.[5] Cumins and Midlo coined the term dermatoglyphics.[6]

Schaumann and Alters published a book on dermatoglyphics in medical disorders.[7] Dermatoglyphics serves as a tool to describe, compare and contrast, and at times predict occurrences and risks for biomedical events. Oral-submucous fibrosis (OSMF) is a precancerous condition characterized by the accumulation of collagen in the lamina propria of the oral mucosa. This disease affects approximately 0.5% (5 million) people of the population in the Indian subcontinent. Although the available epidemiological evidence indicates that the chewing of gutkha and use of tobacco (smoking and nonsmoking) is an important risk factor for OSMF, not all individuals develop OSMF. Patients without any risk factors also develop a malignancy. Genetic predisposition might explain such an individual variability.[8][9] The genetic susceptibility to these potentially malignant and malignant conditions can
Palmar dermatoglyphics of smokeless tobacco users

Vijayaraghavan and Aswath

Indian Journal of Dental Research, 26(5), 2015

486

be determined by studying palmar dermatoglyphics. The genetic alterations probably alter the oral epithelium making it more susceptible for oral malignancy.

Dermatoglyphics might help to identify the risk of occurrence of OSMF among smokeless tobacco users. As there is a paucity of literature on this subject, there are still a lot of scopes for studies to be conducted in order to universalize the finding of dermatoglyphics in this condition.

QUALITATIVE ANALYSIS

The finger ridge patterns were observed to find the pattern predominance, and the results were statistically analyzed by Chi-square test. It was found that the whorls pattern were predominant in controls (35.5%) when compared with the OSMF (23.7%) and oral cancer patients (14.6%) (P < 0.001). Loops were more predominant in OSMF patients (27%) and cancer patients (30.6%) when compared with the controls (18.8%) (P < 0.001). Arches were found to be predominant in OSMF patients (18.5%) and oral cancer patients (51.8%) when compared with the controls (P = 0.003) [Table 1]. However, in patients with habits without lesions the whorls were less compared with the controls (25.9%) and the arches were more (29.6%) when compared with the OSMF patients which explain that these patients are at high risk of oral cancer.

The hypothenar area in the palm was analyzed to find the pattern predominance, and results were statistically analyzed by Pearson Chi-square test. The hypothenar pattern was absent in the controls and in patients having habits without any lesion [Table 2]. It was present in the patients OSMF (55%) and in oral cancer patients (45%) (P < 0.001).

QUANTITATIVE ANALYSIS

The mean ATD angle of the left and right hand was calculated in the four study groups. The mean ATD angle in the controls was 45.70° with a standard deviation of ±1.35, and in the patients with habit without lesion it was 44.90° with a standard deviation of ±3.56. However, on comparison with the controls, the ATD angle in the OSMF and oral cancer patients was less than 45°. In OSMF patients, it was 41.88° with a standard deviation of ±2.21 and in oral cancer patients it was 40.95° with a standard deviation of ±2.46 [Table 3]. The results were statistically analyzed by one-way ANOVA test and a P value of 0.000 (P < 0.001) was obtained [Table 3]. Further analysis of the ATD angle

Table 1: The finger ridge patterns among the study groups

<table>
<thead>
<tr>
<th></th>
<th>Controls (n=10)</th>
<th>Habits without any lesion (n=10)</th>
<th>SMF cases (n=10)</th>
<th>Cancer patients (n=10)</th>
<th>Kruskal-Wallis test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Percentage</td>
<td>Frequency</td>
<td>Percentage</td>
<td>Frequency</td>
<td>Percentage</td>
</tr>
<tr>
<td>Arches</td>
<td>0</td>
<td>8</td>
<td>5</td>
<td>14</td>
<td>13.706</td>
</tr>
<tr>
<td>Whorls</td>
<td>63</td>
<td>46</td>
<td>42</td>
<td>26</td>
<td>35.427</td>
</tr>
<tr>
<td>Loops</td>
<td>37</td>
<td>46</td>
<td>53</td>
<td>60</td>
<td>20.815</td>
</tr>
</tbody>
</table>

SMF=Sub mucous fibrosis

Table 2: The hypothenar pattern among the study groups

<table>
<thead>
<tr>
<th>Hypothenar pattern</th>
<th>Control n (%)</th>
<th>Habits without any lesion n (%)</th>
<th>SMF cases n (%)</th>
<th>Cancer patients n (%)</th>
<th>Pearson chi-square test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>11 (55.00)</td>
<td>9 (45.00)</td>
<td>27.200</td>
</tr>
<tr>
<td>No</td>
<td>20 (33.33)</td>
<td>20 (33.33)</td>
<td>9 (15.00)</td>
<td>11 (18.34)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>20 (100.0)</td>
<td>20 (100.0)</td>
<td>20 (100.0)</td>
<td>20 (100.0)</td>
<td></td>
</tr>
</tbody>
</table>

SMF=Sub mucous fibrosis

Table 3: The ATD angle among the study groups

<table>
<thead>
<tr>
<th></th>
<th>Control Mean±SD</th>
<th>Minimum-maximum</th>
<th>Habits without any lesion Mean±SD</th>
<th>Minimum-maximum</th>
<th>SMF cases Mean±SD</th>
<th>Minimum-maximum</th>
<th>Cancer patients Mean±SD</th>
<th>Minimum-maximum</th>
<th>One‑way ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATD angle</td>
<td>45.70±1.35</td>
<td>44-49</td>
<td>44.90±3.56</td>
<td>35-50</td>
<td>41.88±2.21</td>
<td>37-45</td>
<td>40.95±2.46</td>
<td>35-44</td>
<td>16.641</td>
</tr>
</tbody>
</table>

SD=Standard deviation, ANOVA=Analysis of variance, SMF=Sub mucous fibrosis

Table 4: The mean AB ridge count among the study groups

<table>
<thead>
<tr>
<th></th>
<th>Control Mean±SD</th>
<th>Minimum-maximum</th>
<th>Habits without any lesion Mean±SD</th>
<th>Minimum-maximum</th>
<th>SMF cases Mean±SD</th>
<th>Minimum-maximum</th>
<th>Cancer patients Mean±SD</th>
<th>Minimum-maximum</th>
<th>One‑way ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>41.20±3.33</td>
<td>36-48</td>
<td>39.60±3.95</td>
<td>32-48</td>
<td>37.00±3.42</td>
<td>31-43</td>
<td>38.30±4.23</td>
<td>30-47</td>
<td>4.586</td>
<td>0.005</td>
</tr>
</tbody>
</table>

SD=Standard deviation, ANOVA=Analysis of variance, SMF=Sub mucous fibrosis

[Downloaded free from http://www.ijdr.in on Friday, January 01, 2016, IP: 115.111.224.207]
by *Post-hoc* test shows that there is no decrease in the ATD angle in patients with habits without lesions when compared with the controls ($P > 0.05$), whereas there is a decrease in the ATD angle in OSMF patients and oral cancer patients ($P < 0.001$) when compared with the controls and there is no further decrease in the ATD angle between the OSMF and oral cancer patients ($P > 0.05$). The mean AB ridge count of both left and right hand was calculated in the four groups, and the results were statistically analyzed by one-way ANOVA test [Table 4]. The AB ridge count in the controls was 41.20 with a standard deviation of ±3.33 and in the patients with habit without lesion the AB ridge count was 39.60 ± 3.95. The frequency of AB ridge count in the OSMF and the oral cancer patients was slightly decreased in comparison with the controls. The AB ridge count in the OSMF patients was 37 ± 3.42, and in the oral cancer patients it was 38.30 ± 4.23 ($P = 0.005$). In our study, there was a significant difference in the AB ridge count when the control and the OSMF and oral cancer patients were compared.

To conclude, our study confirms that there is a qualitative and quantitative variation in the palmar dermatoglyphics in oral submucous fibrosis and oral cancer patients when compared with smokeless tobacco chewers without any lesion and controls. There is predominance of arches and loops, presence of hypothenar pattern, decrease in mean ATD angle and total AB ridge count in OSMF and oral cancer patients. In patients with habits without lesions the whorls were less compared with the controls (25.9%) and the arches were more (29.6%) when compared with the OSMF patients, which explains that these patients are at high risk of oral cancer. The main limitation of the study, is that the dermatoglyphic patterns cannot be recorded if the palms are malformed. A prospective study on a larger sample needs to our study further proves that palmar dermatoglyphics can be used as an effective tool determining the progress toward OSMF and oral squamous-cell carcinoma in smokeless tobacco users without any lesion.

**REFERENCES**


How to cite this article: Vijayaraghavan A, Aswath N. Qualitative and quantitative analysis of palmar dermatoglyphics among smokeless tobacco users. Indian J Dent Res 2015;26:483-7.

**Source of Support:** Nil, **Conflict of Interest:** None declared.